

CS70 HW2 Reading

James Essinger. Jacquard's web : how a hand-loom led to the birth of the information age

Excerpt from Chapter 5: From Weaving to Computing

And now here we are at Number One Dorset Street, Charles Babbage's London home. Babbage, forty-seven years old, is sitting at his writing-desk in his study. He takes out his pen, dips it into an inkwell, and starts to write a letter to a Parisian friend.

The particular friend Babbage is writing to as we meet him is the French astronomer and scientist, François Jean Dominique Arago. Babbage got to know Arago in Paris back in 1819 when he travelled there with John Herschel, a close companion from his Cambridge days. Babbage and Arago hit it off at once. They have been friends ever since. When Babbage corresponds with Arago he does so in English, while Arago replies in French. They both understand each other's native languages, but prefer to express themselves in their own.

'My dear sir,' Babbage writes:

I am going to ask you to do me a favour.

There has arrived lately in London ... a work which does the highest credit to the arts of your country. It is a piece of silk in which is woven by means of the Jacard [sic] loom a portrait of M. Jacard sitting in his workshop. It was executed in Lyons as a tribute to the memory of the discoverer of a most admirable contrivance which at once gave an almost boundless extent to the art of weaving.

It is not probable that that copy will be seen as much as it deserves and my first request is, *if* it can be purchased, that you will do me the favour to procure for me two copies and send them to Mr Henry Bulwer at the English Embassy who will forward them. If, as I fear, this beautiful production is not sold, then I rely on your friendship to procure for me *one* copy by representing in the proper quarter the circumstance which makes me anxious to possess it.

This letter is the first mention in Babbage's surviving correspondence of the woven portrait of Jacquard—the exhibit which, the following year, he was to make a conversation piece at his Saturday soirées. Babbage was so fascinated with Jacquard and the 'most

admirable contrivance' he had invented that he asked Arago, in the same letter, to send 'any memoir which may be published of M. Jacard'. Money was no object to Babbage, so keen was he to get what he wanted. Although he was mis-spelling Jacquard's name, he had no misapprehension about the revolution the Jacquard loom had created in the story of technology:

Whatever these things may cost, if you will mention to me the name of your banker in Paris I will gladly pay the amount into his hands and shall still be indebted to you for procuring for me objects of very great interest.

Babbage's letter then proceeds to the hub of the matter. The Englishman explains exactly why he is so fascinated by the Frenchman's work:

You are aware that the system of cards which Jacard invented are the *means* by which we can communicate to a very ordinary loom orders to weave *any* pattern that may be desired. Availing myself of the same beautiful invention I have by similar means communicated to my Calculating Engine orders to calculate *any* formula however complicated. But I have also advanced one stage further and without making *all* the cards, I have communicated through the same means orders to follow certain *laws* in the use of those cards and thus the Calculating Engine can solve any equations, eliminate between any number of variables and perform the highest operations of analysis.

Among Charles Babbage's many contributions to the birth of information technology, the most significant was that he spotted a way to adapt Jacquard's punched-card programming to a completely new purpose: *mathematical calculation*.

At a technical level, Babbage really did borrow Jacquard's idea lock, stock, and barrel. Babbage saw that just as Jacquard's loom employed punched cards to control the action of small, narrow, circular metal rods which in turn governed the action of individual warp threads, *he himself could use the same principle to*

control the positions of small, narrow, circular metal rods that would govern the settings of cogwheels carrying out various functions in his calculating machine.

As a result of this insight, Babbage was able to design the only machine of the entire nineteenth century that was even more complex than Jacquard's loom.

The conceptual link Babbage made between his own work and Jacquard's is beyond doubt one of the greatest intellectual breakthroughs in the history of human thought. It is a leap of the scientific imagination that is too easy to take for granted today, when computers and information technology are all around us, when we are so familiar with the role that computers and the Internet play in our lives, and when we use on a routine, daily basis, machines that are essentially special kinds of Jacquard looms built to weave information rather than fabric.

This is not to imply that computers would never have come about if the Jacquard loom had never existed. Computers are so useful that it is difficult to believe a technologically sophisticated society would not have invented some other machines for processing information if there had never been a Jacquard loom. But if the Jacquard loom *had* never existed, computers would certainly look and work very differently from how they look and work today.

Babbage's Difference Engine, with which he was occupied for around twelve years, from 1821 to about 1833, was to be an automatic cogwheel-based machine designed to calculate and print mathematical tables. Brilliantly ingenious, as it was, it still fell far short of the fully automated and versatile general mathematical machine—in effect a Victorian computer made from cogwheels—that Babbage eventually glimpsed on the most distant regions of his intellectual horizon. The precise link with Jacquard's work does not appear to have occurred to Babbage until the mid-1830s, when he conceived of a much more ambitious and complex device than the Difference Engine. He later christened this new machine the Analytical Engine.